

CLAIMS

1. A polarizing element, wherein the polarizing element has a two-layer structure in which a grating pattern having a constant period Λ is formed in a substrate, a cross section of the grating pattern having a rectangular shape, and a film having a refractive index higher than that of the substrate is deposited on the grating pattern, $\Lambda \cos \theta_0 < \lambda$ where λ is a wavelength and θ_0 is an angle of incidence to a grating surface, and the grating period, a grating height, and a film thickness are determined such that reflection efficiency of zero-order diffracted light of TE polarization is not lower than a predetermined value while transmission efficiency of zero-order diffracted light of TM polarization is not lower than the predetermined value.

2. A polarizing element according to claim 1, wherein the predetermined value is 0.8.

3. A polarizing element, wherein the polarizing element has a two-layer structure in which a grating pattern having a constant period Λ is formed in a substrate, a cross section of the grating pattern having a triangular shape, and a film having a refractive index higher than that of the substrate is deposited on the grating pattern, $\Lambda \cos \theta_0 < \lambda$ where λ is a wavelength and θ_0 is an angle of incidence to a grating surface, and the grating period, a grating height, and a film thickness are determined such that reflection efficiency of zero-order diffracted light of one of TE polarization and TM polarization is not lower than a predetermined value while transmission efficiency of zero-order diffracted light of the other of TE polarization and TM polarization is not lower than the predetermined value.

4. A polarizing element according to claim 3, wherein the predetermined value is 0.7.

5 5. A polarizing element, wherein the polarizing element has a two-layer structure in which a grating pattern having a constant period Λ is formed in a substrate, a cross section of the grating pattern having a triangular shape, and a film having a refractive index higher than that of the substrate is deposited on the grating pattern, in the case where a first
10 wavelength λ_1 and a second wavelength λ_2 satisfy a relationship of $\lambda_1 < \lambda_2$, $\Lambda \cos \theta_0 < \lambda_1$ where θ_0 is an angle of incidence to a grating surface, and the grating period, a grating height, and a film thickness are determined such that reflection efficiency of zero-order diffracted light of TE polarization is not lower than a predetermined value for the first wavelength λ_1 while
15 transmission efficiency of zero-order diffracted light of TM polarization is not lower than the predetermined value for the first wavelength λ_1 , and such that transmission efficiency of the zero-order diffracted light of the TE polarization is not lower than the predetermined value for the second wavelength λ_2 while reflection efficiency of the zero-order diffracted light of
20 TM polarization is not lower than the predetermined value for the second wavelength λ_2 .

6. A polarizing element according to claim 5, wherein the predetermined value is 0.7.

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7. A polarizing element, wherein the polarizing element has a two-layer structure in which a grating pattern having a constant period Λ is

formed in a substrate, a cross section of the grating pattern having a triangular shape, and a film having a refractive index higher than that of the substrate is deposited on the grating pattern, in the case where a first wavelength λ_1 and a second wavelength λ_2 satisfy a relationship of $\lambda_1 < \lambda_2$, $\Lambda \cos \theta_0 < \lambda_1$ where θ_0 is an angle of incidence to a grating surface, and the grating period, a grating height, and a film thickness are determined such that reflection efficiency of zero-order diffracted light of TE polarization is not lower than a predetermined value for the first wavelength λ_1 while transmission efficiency of zero-order diffracted light of TM polarization is not lower than the predetermined value for the first wavelength λ_1 , and such that reflection efficiency of the zero-order diffracted light of TE polarization is not lower than the predetermined value for the second wavelength λ_2 while transmission efficiency of the zero-order diffracted light of TM polarization is not lower than the predetermined value for the second wavelength λ_2 .

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8. A polarizing element according to claim 7, wherein the predetermined value is 0.7.

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9. A polarizing element according to any one of claims 1 to 8, wherein the substrate is made of a synthetic resin.

10. A polarizing element according to claim 9, wherein the substrate is made of a transparent resin such as acryl and polyolefin.

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11. A polarizing element according to any one of claims 1 to 10, wherein the grating pattern of the substrate is formed by transfer from a metal mold.

12. A polarizing element according to any one of claims 1 to 11,
wherein the film is a deposited film.

5 13. A polarizing element according to claim 12, wherein the deposited
film is made of a material such as TiO_2 having a refractive index higher than
a refractive index of the substrate.

10 14. A polarizing element according to claims 12 or 13, wherein a
thickness of the deposited film is smaller than 0.3 micrometers.

15 15. A polarizing element according to any one of claims 1 to 14,
wherein the grating height is smaller than the grating period.

 16. A polarizing element according to any one of claims 5 to 8,
wherein the first wavelength is the wavelength for a digital versatile disc and
the second wavelength is the wavelength for a compact disc.

20 17. An optical system including a first-wavelength light source, a
second-wavelength light source, and a polarizing element according to any
one of claims 1 to 8, wherein the polarizing element is configured to reflect
light from the light source of any wavelength in order to cause the light to
reach to a disc and to transmit the return light reflected by the disc.

25 18. An optical system including a first-wavelength light source, a
second-wavelength light source, and a polarizing element according to any
one of claims 5 to 8, wherein the polarizing element is configured to reflect

light from the first-wavelength light source and the second-wavelength light source in order to cause the light to reach to a disc and to transmit the return lights reflected by the disc.